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GENETICAL STUDIES ON THE FRESH WATER FISH SYNODONTIS SCHALL

By

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Key words: *Synodontis schall* chromosome-serum and muscl electoresis.

ABSTRACT

The karyological analysis of the fish ***Synodontis schall*** *illustrated that they have diploid number of chromosomes (2n= 56) and FN= 112. The chromosome complement consists of four median centric (m) and 24 submedian centric chromosomes (sm). The electrophoretis analysis for* ***Synodontis schall*** *illustrated the presence of 16 fractions in their serum proteinograms and* only 14 fractions in their muscle proteinograms.

INTRODUCTION

The Nile fish ***Synodontis schall*** (Family: Mochokidae, Order: Siluriformes) is well distributed in the Egyptian inland waters especially in the River Nile and its main branches (Boulanger, 1907). In spite of their fast growing and big size ***Synodontis schall*** is not used in the Egyptian fish farming system due to many difficulties met with their reproduction and farming. Recently, many efforts have been made to study fish chromosomes. Chromosomal analysis (especially in fish) can be useful for species identification and addressing a variety of evolutionary and genetic questions about fish (Kligerman & Bloom, 1977 and Fitzsimans ***et al.***; 1988).

The present work aimed to study the karyottpe of ***Synodontis scuall*** Also, to study their serum and muscle electrophoretic proteinograms.

MATERIALS AND METHODS

In the present work, twenty healthy individuals of ***Synodontis schall*** were stocked in aquaria supplied continuously with dechlorinized tap water every other day. They were fed twice per day for two weeks before scarificing.

Chromosomes were prepared according to kligerman and bloom (1977) with some modifications the fish were injected intraperitoneally with 0.5% colchicine solution (0.01ml/1g body weight of fish), put in well aerated aquarium and density fed. After 3 hours, the fish were sacrificed, head kidneys were taken and minced in a hypotonic solution (0.56% KCI). The suspension was left for 30 minutes at 37°C and centrifuged at 800rmp. The supernatant was then removed and the cells were resuspended by adding iced fixative (3 methanol: 1 glacial acetic acid) dropwise. This step was repeated three times. The suspended cells in few fixative were smeared on clean slides and left to dry. The prepared slides were stained in 15% Giemsa stain solution for 45 minutes.

Nomenclature of the chromosomes for centromeric position was calculated according to Levan ***et. al***. (1964) from the arm ratio which is the ratio between the long arm (I) and the short arm (S): r= I/S as follows:

* 1 to less than 1.7 median centromeric chromosome (m).
* 1.7 to less than 3 submedian centromeric chromosome (sm).
* 3 to less than 7 subterminal centromeric chromosome (st).

For calculating the fundamental number (FN) (total number of the principal chromosomal arms), median and submedian chromosomes were considered as biarmed.

For electrophoretic investigations, serum and muscle proteins of the same specimens of ***Synodontis schall*** were analysed electrophoretically using disc electrophoresis of 7.5% (Herzberg & Pasteur, 1975). The gels were stained in Amidoblack 10B, destained in 7% acetic acid and scanned using densitometer.

RESULTS

Table (1) and Figure (1A & b) show that ***Synodontis schall*** have the diploid number of chromosomes of 2n= 56. The arm ratio of the chromosome ranged between 1.292 to 2.410. Therefore, the chromosomal types are in the range of the median (m) and submedian (sm) types. The karyotype of the diploid chromosomal set 28 pairs of ***Synodontis schall*** is four pairs median centromeric (m) chromosomes (No. 2, 26 & 27) and 24 pairs submedian centromeric (sm) chromosomes (No.: 1.3 – 18.20 – 25 & 28). So, the chromosomal fundamental number (FN) is 112.

On the other hand, the mean total length, of the chromosomes ranged between 7.55 ± 0.800µm to 15.940 ± 2.690µm. While, the total mean lengths of the basic set of chromosomes is 308.93µm.

The biochemical electrophoretic analysis for serum protein of ***Synodontis schall*** showed 16 fractions in their serum proteinograms, but only 14 fractions were observed in the muscle (myogen) proteinograms, (Table 2 and Fig. 2A & B).

DISCUSSION

The freshwater fish ***Synodontis schall*** is a-popular fish with the majority of the Egyptian people espcially those living around the River Nile, its main branches and lake Nasser. ***Synodontis schall*** fish represent a considerable part of the total catch of the River Nile, its main branches and lake Nasser but is not found in the fish ponds or shallow water bodies. This may be due to its special habits in reproduction and growing.

The present work is the first to report on the karyotype and proteingrams of ***Synodontis schall***. The diploid chromosome complement is 56 (2n= 56) and chromomal arm numbers (FN) are 112. The chromosomal arm ratios ranged between 1.292-2.410. Therefore, the chromosomes are in the range of median (m) and submedian (sm) centromertic positions (Levan ***et al***.. 1964). Also, the

Table (1) : Range, mean and SD (in micron) for the short arm, long arm and mean total lengths of the haploid set of chromosomes for *Synodontis schall*

Chrom-osome No.	*Synodontis shall*							
	Short arm		Long arm		Mean total		Arm ratio	Type
	Range µm	Mean + SD µm	Range µm	Mean + SD µm	Range µm	Mean + SD µm		
1	3.150 - 9.900	4.890 ± 1.970	8.780 - 17.30	10.87 ± 2.680	15.40 - 22.20	15.940 ± 2.690	2.223	sm
2	3.150 - 9.900	5.330 ± 2.050	5.400 - 16.20	9.080 ± 2.360	14.20 - 21.20	14.510 ± 2.300	1.705	m
3	2.480 - 8.100	4.430 ±1.500	8.100 - 14.90	9.510 ± 1.930	13.50 - 20.00	14.010 ± 2.230	2.184	sm
4	2.700 - 7.650	4.720 ± 1.520	7.200 - 14.90	8.560 ± 2.220	21.90 - 91.10	13.360 ± 2.150	1.815	sm
5	3.600 - 7.200	4.740 ±1.000	6.750 - 11.90	8.060 ± 1.540	12.70 - 17.30	12.360 ± 1.750	1.702	sm
6	3.150 - 7.650	4.490 ± 1.110	6.750 - 11.50	7.970 ± 1.450	12.60 - 16.50	12.500 ± 1.530	1.775	sm
7	2.480 - 8.550	4.150 ± 1.410	6.750 - 12.20	8.050 ± 1.680	12.20 - 16.30	12.210 ± 1.560	1.941	sm
8	2.700 - 6.980	4.080 ± 1.120	6.750 - 12.40	7.910 ± 1.640	12.20 - 16.10	12.020 ± 1.500	1.938	sm
9	2.930 - 5.400	3.640 ± 0.880	7.200 - 11.90	8.140 ± 1.440	11.90 - 16.00	11.800 ± 1.520	2.238	sm
10	2.930 - 6.300	4.140 ± 1.010	6.750 - 11.70	7.380 ± 1.380	11.60 - 15.50	11.540 ± 1.420	1.785	sm
11	2.700 - 5.400	3.350 ± 0.880	6.080 - 12.40	8.060 ± 1.470	11.50 - 15.20	11.430 ± 1.350	2.410	sm
12	2.250 - 6.750	3.890 ± 1.150	6.300 - 10.40	7.260 ± 1.220	11.40 - 14.90	11.150 ± 1.280	1.867	sm
13	2.480 - 6.300	3.760 ± 0.990	6.300 - 11.70	7.200 ± 1.210	11.30 - 14.30	10.980 ± 1.160	1.913	sm
14	1.800 - 8.100	4.040 ± 1.520	6.530 - 10.60	7.040 ± 1.040	11.30 - 14.40	11.100 ± 1.310	1.743	sm
15	2.480 - 6.300	3.340 ± 1.030	6.300 - 10.60	7.450 ± 1.160	11.10 - 14.00	10.800 ± 1.080	2.232	sm
16	2.250 - 6.750	3.770 ± 1.090	5.850 - 9.230	6.910 ± 0.960	10.80 - 14.00	10.710 ± 1.130	1.831	sm
17	0.610 - 6.080	3.490 ± 1.300	5.850 - 9.230	6.650 ± 1.130	10.70 - 13.70	10.150 ± 1.010	1.906	sm
18	2.480 - 5.400	3.390 ± 0.900	5.630 - 11.30	6.790 ± 1.600	10.50 - 13.60	10.220 ± 1.190	2.003	sm
19	2.700 - 4.500	3.700 ± 0.700	5.630 - 9.680	6.260 ± 1.180	10.40 - 13.20	9.9800 ± 1.030	1.693	m
20	1.800 - 5.400	3.390 ± 0.940	5.850 - 9.680	6.470 ± 1.110	10.20 - 12.90	9.8800 ± 0.990	1.909	sm
21	1.580 - 5.400	3.160 ± 1.000	5.180 - 10.60	6.550 ± 1.250	10.10 - 12.80	9.7300 ± 0.990	2.072	sm
22	2.030 - 5.400	3.170 ± 0.990	5.180 - 8.330	6.310 ± 0.980	9.790 - 12.60	9.4900 ± 1.010	1.989	sm
23	1.350 - 5.400	3.350 ± 0.960	5.400 - 8.550	5.860 ± 1.020	9.680 - 12.40	9.2200 ± 0.960	1.753	sm
24	1.350 - 4.950	3.080 ± 1.040	4.730 - 9.450	5.790 ± 1.310	9.110 - 12.20	8.8600 ± 1.010	1.879	sm
25	1.350 - 5.400	2.770 ± 1.010	4.950 - 9.900	5.950 ± 1.200	8.780 - 11.80	8.7100 ± 0.990	2.144	sm
26	2.030 - 5.400	3.230 ± 0.990	4.280 - 7.880	5.170 ± 0.970	8.440 - 11.70	8.4700 ± 1.030	1.602	m
27	2.250 - 31.70	3.980 ± 6.110	4.280 - 7.430	5.150 ± 0.920	7.880 - 23.00	9.2500 ± 4.490	1.292	m
28	2.030 - 3.600	2.350 ± 0.520	4.500 - 8.100	5.320 ± 1.220	7.650 - 10.10	7.5500 ± 0.800	2.261	sm
Total						308.93		

A

B

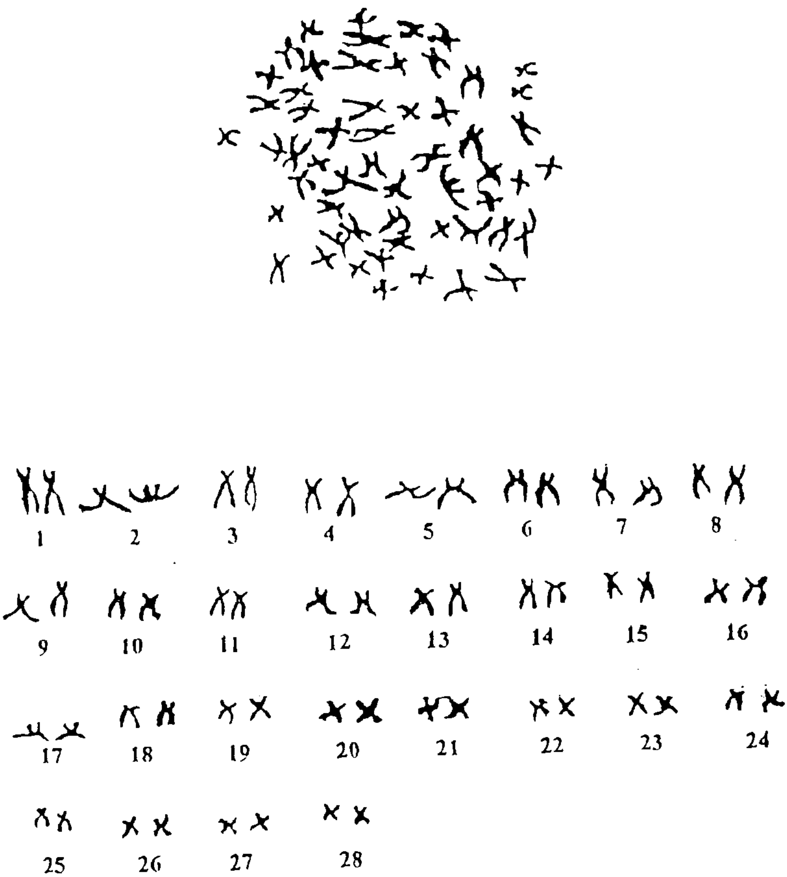

Fig. (1) : Metaphase stage of the chromosomes of *Synodontis schall*

A- metaphase **B- Karyptype**

Table (2): Relative mobility and relative area for serum and muscle proteinograms of *Synodontis schall*

Synodontis schall					
Fractions		Serum		Muscle	
No.	Mean + SD	Mobility	Area	Mobility	Area
1	X\	100	4.8	100	7.4
	+ SD	0	0.82	0	1.22
2	X\	92.0	5.9	83.3	3.6
	+ SD	2.56	1.12	3.15	0.89
3	X\	87.8	8.0	76.8	4.8
	+ SD	3.21	1.56	4.51	0.94
4	X\	85	4.6	70.3	4.3
	+ SD	2.54	1.11	2.89	1.12
5	X\	81.5	4.1	66.9	11.6
	+ SD	2.89	0.56	4.53	2.11
6	X\	78.4	8.3	63.5	17.1
	+ SD	4.12	1.47	3.45	3.12
7	X\	66.2	2.8	58.7	1.6
	+ SD	2.98	0.25	2.65	0.25
8	X\	59.6	12.3	55.3	2.1
	+ SD	4.15	3.15	3.41	0.56
9	X\	45.3	6.5	48.1	3.4
	+ SD	3.13	1.23	2.89	1.89
10	X\	41.8	5.6	40.6	3.4
	+ SD	2.39	1.11	3.48	1.11
11	X\	38.7	4.8	37.2	15.8
	+ SD	4.12	0.85	4.45	2.89
12	X\	35.5	3.8	32.1	10.6
	+ SD	1.38	1.21	3.12	3.14
13	X\	32.8	5.3	25.9	7.2
	+ SD	254	0.97	1.78	2.56
14	X\	29.3	10.4	1.64	7.2
	+ SD	2.56	3.11	2.58	2.67
15	X\	25.4	5.3		
	+ SD	3.11	1.22		
16	X\	22.6	7.6		
	+ SD	2.31	1.91		

mean total lengths of chromosomes ranged between 7.550 ± 0.800μm - 15.940 ± 2.690μm and the total mean length of the haploid set is 308.93μm.

On the other hand, the biochemical electrophoretic investigation shows that the serum protein grams of ***Synodontis schall*** have 16 fractions and 147 ones only for the muscle proteinograms.

The present work is in great similarity with those obtained from ***Clarias lazera*** (now ***Clarias gariepinus***) either for chromosomes or for serum and muscle proteinogams (Badawy, 1998; Badawy & El-Serafy, 1998; El-Serafy & Badawy, 1998).

Also, there is a great similarity between the present results and those reported by Legande (1981) who noted that a diploid chromosome number of 56 ± 2 was wide spread among 70 species of cat fishes in ten siluroid families and was especially frequent in four families: Ariidae, Bagridae, Ictaluridae and Bimelodidae.

Rab (1981) and Vasiliesv (1985) mentioned that in siluroid families chromosomes and/or arm numbers exhibit a great variability and it may be assumed that karyotype is specific and that this criterion can be used for species characterization.

Srivastava and Bhagwan (1986) reported chromosome complement of 2n= 52 for ***Clarias batrachus*** (Clariidae, Siluriformes). The chromosomes were typed as: One pair metacentric (M) centromere is exactly at the midpoint of the chromosomal arms) which is the largest of all, 2 pairs metacentric (m, centromere is at the medium region, but not at the exact midpoint-Levan ***et al.***, 1964) which is medium in size between the first one and the remainders, 21 pairs telocentric (t) having small size and 2 pairs of another telocentric with much smaller size

Teugle (1986) and Teugle ***et. al*** (1992) reported the same chromosome number 2n= 56 nearly identical chromosome formula in ***Clarias anguillaris*** and ***C. fusus*** (Clariidae, siluriformes)

Ozouf-Costaz ***et. al.*** (1990) reported that the African catfish ***Clarias gariepinus*** (Clariidae) showed chromosomal type of 8 median centric, 24

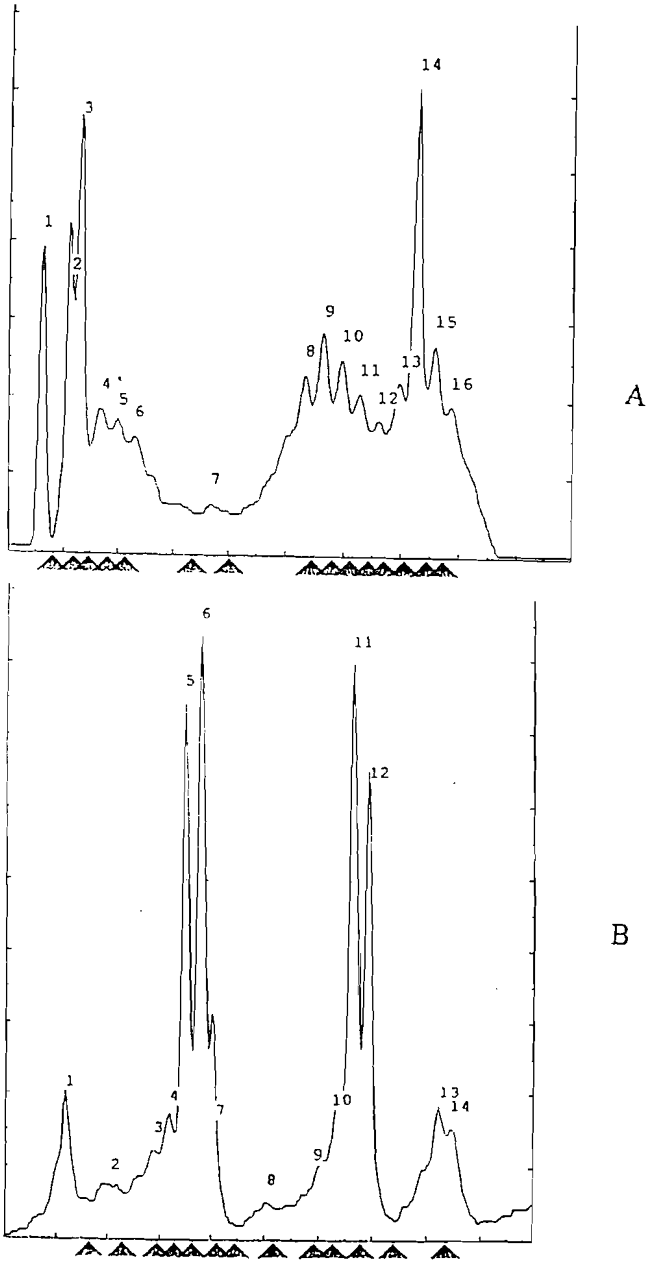

Fig.(2) : Electrophoretic proteinograms for the serum and muscle of *Synodontis schall*

A-serum proteinogram of B- Muscle proteinograd submedian centric and 24 acrocentric chromosomes with arm number (FN) of 88 for males. While, their females have 8 median centric, 25 submedian and 23 acrocentric chromosomes with arm number (FN) of 89.

Madcoure ***et. al.*** (1995) described a chromosomal complement of 2n= 56 for ***C. lazera*** with FN= 86. The chromosomal types were 15 pairs of submetacentric (sm), 10 pairs of submetacentric (st) and three pairs of telocentric chromosomes (t). The total mean length of the chromosomes ranged between 2.38µm-0.57µm. with total mean length of haploid set (n= 28) of chromosomes of 36.7µm. the arm ratios ranged between 0.00-0.24µm.

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